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(54) Title: ABSORBENT ARTICLES HAVING AN ODOUR CONTROL SYSTEM COMPRISING SILICA, ZEOLITE AND ABSORBENT GELLING MATERIAL		
(57) Abstract <p>The present invention relates to absorbent articles in particular sanitary napkins which have an odour control system incorporated therein which provides improved odour control benefits. The odour control system comprises the combination of zeolite, silica and absorbent gelling material.</p>		

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ABSORBENT ARTICLES HAVING AN ODOUR CONTROL SYSTEM COMPRISING SILICA, ZEOLITE AND ABSORBENT GELLING MATERIAL

Field of the Invention

The present invention relates to absorbent articles, in particular sanitary napkins and panty liners comprising compositions providing odour control benefits.

Background of the Invention

Whilst the primary focus of absorbent articles remains the ability of these articles to absorb and retain fluids, another important area of development in this field is the control of odorous compounds contained within the absorbed fluids or their degradation products. There are a wide range of compounds which may be present in an absorbent article during use which result in the formation of malodorous. These compounds include fatty acids, ammonia, amines, sulphur containing compounds and ketones and aldehydes.

The art is replete with descriptions of various odour controlling agents for use in absorbent articles in order to address the problem of malodour formation. These agents can typically be classified according to the type of odour the agent is intended to combat. Odours may be classified as being acidic, basic or neutral. Acidic odour controlling agents have a pH greater than 7 and typically include inorganic carbonates, bicarbonates, phosphates and sulphates. Basic odour controlling agents have a pH of less than 7 and include compounds such as citric acid, boric acid and maleic acid.

Neutral odour controlling agents have a pH of approximately 7. Examples of these types of compounds include activated carbons, clays, zeolites, silicas and starches. Such neutral odour controlling agents are most commonly utilised in absorbent articles.

For example EPO 348 978 discloses an absorbent article comprising an odour control system wherein the neutral odour controlling particles are selected from carbon, clays, silicas, zeolites and molecular sieves. EPO 510 619 relates to absorbent article comprising odour control complex including a combination of at least 2 agents selected from a group which includes zeolites and silica gels. Similarly, WO 91/12029 discloses the combination of zeolites and absorbent gelling materials to provide improvement in the control of ammonia odours.

Carbon has been noted in the art as being particularly effective over a broad spectrum of odours. However, it is not favoured due to its black appearance, which is considered unacceptable by consumers. For example EPO 282 287 discloses a deodouriser suitable for use in a sanitary napkin which is non black (i.e. carbon free) comprising at least one compound selected from metal silicates and metal salts of aluminum containing silicates selected from certain transition metals and group II metals.

The currently preferred odour control agent is zeolite, particularly the so-called intermediate and high ratio zeolites. Although zeolite does not have a negative aesthetic profile, its main drawback is its lack of effective odour control over a broad range of odour types and the cost of such materials particularly the intermediate and high ratio zeolites.

Hence, there still exists a need to provide an odour controlling agent or system which has an acceptable aesthetic profile such that it is light coloured and provides effective odour control over a wide range of malodorous compounds which may be present in an absorbent article and which is not expensive.

It has now been observed that this need may be addressed by the use of the specific combination of zeolite, silica and an absorbent gelling material. Surprisingly, it has been observed that this combination of zeolite, silica and absorbent gelling material results in a synergic odour control effect not previously anticipated.

Summary of the Invention

The present invention relates to an absorbent article comprising a liquid pervious topsheet, a backsheet and an absorbent core intermediate said topsheet and said backsheet, characterised in that said absorbent article comprises an odour control system comprising the combination of zeolite, silica and absorbent gelling material.

Detailed Description of the Invention

The present invention relates to absorbent disposable articles such as sanitary napkins, baby diapers, incontinence products and panty liners. The absorbent article of the present invention comprises the essential features of a liquid pervious topsheet a backsheet and an absorbent core intermediate the topsheet and the backsheet. The absorbent article further comprises as an essential component an odour control system.

Odour control system

According to the present invention the absorbent article comprises as an essential feature an odour control system which comprises the combination of zeolite, silica and absorbent gelling material. The odour control system has been found to provide effective odour control over a broad spectrum of odours, typically found in absorbent articles.

Absorbent gelling materials

The odour control system thus comprises as an essential component an absorbent gelling material. As is well-known from recent commercial practice, absorbent gelling materials (sometimes referred to as "super-sorbers") are becoming broadly used in absorbent articles. AGM's are materials which have fluid-absorbing properties. Such materials form hydrogels on contact with water (e.g., with urine, blood, and the like). One highly preferred type of hydrogel-forming, absorbent gelling material is based on polyacids, especially polyacrylic acid. Hydrogel-forming polymeric materials of this type are those which, upon contact with fluids (i.e., liquids) such as water or body fluids, imbibe such fluids and thereby form hydrogels. These preferred absorbent gelling materials will generally comprise substantially water-insoluble, slightly cross-linked, partially

neutralized, hydrogel-forming polymer materials prepared from polymerizable, unsaturated, acid-containing monomers. In such materials, the polymeric component formed from unsaturated, acid-containing monomers may comprise the entire gelling agent or may be grafted onto other types of polymer moieties such as starch or cellulose. Acrylic acid grafted starch materials are of this latter type. Thus, the preferred absorbent gelling materials include hydrolyzed acrylonitrile grafted starch, acrylic acid grafted starch, polyacrylates, maleic anhydride-based copolymers and combinations thereof. Especially preferred absorbent gelling materials are the polyacrylates and acrylic acid grafted starch.

Whatever the nature of the polymer components of the preferred absorbent gelling materials, such materials will in general be slightly cross-linked. Crosslinking serves to render these preferred hydrogel-forming absorbent materials substantially water-insoluble, and cross-linking also in part determines the gel volume and extractable polymer characteristics of the hydrogels formed therefrom. Suitable cross-linking agents are well known in the art and include, for example, (1) compounds having at least two polymerizable double bonds; (2) compounds having at least one polymerizable double bond and at least one functional group reactive with the acid-containing monomer material; (3) compounds having at least two functional groups reactive with the acid-containing monomer materials; and (4) polyvalent metal compounds which can form ionic cross-linkages. Cross-linking agents of the foregoing types are described in greater detail in Masuda et al; U.S. Patent 4,076,663; Issued February 28, 1978. Preferred cross-linking agents are the di- or polyesters of unsaturated mono- or polycarboxylic acids with polyols, the bisacrylamides and the di- or triallyl amines. Especially preferred cross-linking agents are N,N'-methylenebisacrylamide, trimethylol propane triacrylate and triallyl amine. The cross-linking agent will generally comprise from about 0.001 mole percent to 5 mole percent of the preferred materials. More preferably, the cross-linking agent will comprise from about 0.01 mole percent to 3 mole percent of the gelling materials used herein.

The preferred, slightly cross-linked, hydrogel-forming absorbent gelling materials will generally be employed in their partially neutralized form. For purposes described herein, such materials are considered partially neutralized when at least 25 mole percent, and preferably at least 50 mole percent of

monomers used to form the polymer are acid group-containing monomers which have been neutralized with a salt-forming cation. Suitable salt-forming cations include alkali metal, ammonium, substituted ammonium and amines. This percentage of the total monomers utilized which are neutralized acid group-containing monomers is referred to as the "degree of neutralization". Typically, commercial absorbent gelling materials have a degree of neutralization somewhat less than 90%.

The preferred absorbent gelling materials used herein are those which have a relatively high capacity for imbibing fluids encountered in the absorbent articles; this capacity can be quantified by referencing the "gel volume" of said absorbent gelling materials. Gel volume can be defined in terms of the amount of synthetic urine absorbed by any given absorbent gelling agent buffer and is specified as grams of synthetic urine per gram of gelling agent.

Gel volume in synthetic urine (see Brandt, et al, below) can be determined by forming a suspension of about 0.1-0.2 parts of dried absorbent gelling material to be tested with about 20 parts of synthetic urine. This suspension is maintained at ambient temperature under gentle stirring for about 1 hour so that swelling equilibrium is attained. The gel volume (grams of synthetic urine per gram of absorbent gelling material) is then calculated from the weight fraction of the gelling agent in the suspension and the ratio of the liquid volume excluded from the formed hydrogel to the total volume of the suspension. The preferred absorbent gelling materials useful in this invention will have a gel volume of from about 20 to 70 grams, more preferably from about 30 to 60 grams, of synthetic urine per gram of absorbent gelling material.

Another feature of the most highly preferred absorbent gelling materials relates to the level of extractable polymer material present in said materials. Extractable polymer levels can be determined by contacting a sample of preferred absorbent gelling material with a synthetic urine solution for the substantial period of time (e.g., at least 16 hours) which is needed to reach extraction equilibrium, by then filtering the formed hydrogel from the supernatant liquid, and finally by then determining the polymer content of the filtrate. The particular procedure used to determine extractable polymer content of the preferred absorbent gelling agent buffers herein is set forth in Brandt, Goldman and Inglin; U.S. Patent 4,654,039; Issues March 31, 1987, Reissue 32,649, The

absorbent gelling materials which are especially useful in the absorbent articles herein are those which have an equilibrium extractables content in synthetic urine of no more than about 17%, preferably no more than about 10% by weight of the absorbent gelling material.

The absorbent gelling materials herein before described are typically used in the form of discrete particles. Such absorbent gelling materials can be of any desired shape, e.g., spherical or semi-spherical, cubic, rod-like polyhedral, etc. Shapes having a large greatest dimension/smallest dimension ratio, like needles and flakes, are also contemplated for use herein. Agglomerates of absorbent gelling material particles may also be used.

The size of the absorbent gelling material particles may vary over a wide range. For reason of industrial hygiene, average particle sizes smaller than about 30 microns are less desirable. Particles having a smallest dimension larger than about 2mm may also cause a feeling of grittiness in the absorbent article, which is undesirable from a consumer aesthetics standpoint. Furthermore, rate of fluid absorption can be affected by particle size. Larger particles have very much reduced rates of absorption. Preferred for use herein are absorbent gelling material s particles substantially all of which have a particle size of from about 30 microns to about 2mm. "Particle Size as used herein means the weighted average of the smallest dimension of the individual particles.

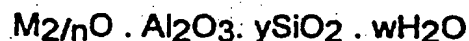
The amount of absorbent gelling material particles used in the present invention will typically range from 20gm^{-2} to 150gm^{-2} , preferably from 40gm^{-2} to 110gm^{-2} , more preferably from 55gm^{-2} to 85gm^{-2} .

Zeolite odour control agent

Suitable zeolite odour control material for use in the odour control system of the present invention is well known in the literature and is described in the following reference texts: ZEOLITE SYNTHESIS, ACS Symposium Series 398, Eds. M. L. Occelli and H. E. Robson (1989) pages 2-7; ZEOLITE MOLECULAR

SIEVES, Structure, Chemistry and Use, by D. W. Breck, John Wiley and Sons (1974) pages 245-250, 313-314 and 348-352; MODERN APPLICATIONS OF MOLECULAR SIEVE ZEOLITES, Ph.D. Dissertation of S. M. Kuznicki, U. of Utah (1980), available from University of Microfilms International, Ann Arbor, Michigan, pages 2-8.

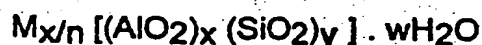
Zeolites are crystalline aluminosilicates of group IA and group IIA elements such as Na, K, Mn, Ca and are chemically represented by the empirical formula :



where y is 2 or greater, n is the cation valence, and w is the water content in the voids of the zeolite.

Structurally, zeolites are complex, crystalline inorganic polymers based on an infinitely extending framework of AlO_4 and SiO_4 tetrahedra linked to each other by sharing of oxygen ions. This framework structure contains channels or interconnected voids that are occupied by the cations and water molecules.

The structural formula of a zeolite is based on the crystal unit cell, the smallest unit of structure, represented by



where n is the valence of cation M, w is the number of water molecules per unit cell, x and y are the total number of tetrahedra per unit cell, y/x usually having values of 1-5.

Zeolites may be naturally derived or synthetically manufactured. The synthetic zeolites being preferred for use herein and include zeolite A, zeolite P, zeolite Y, zeolite X, zeolite DAY, zeolite ZSM-5, and mixtures thereof. Most preferred are zeolite A and zeolite Y and mixtures thereof.

According to the present invention the zeolite is preferably hydrophobic. This is typically achieved by increasing the molar ratio of the SiO_2 to AlO_2

content such that the ratio of x to y is at least 1, preferably from 1 to 500, most preferably from 1 to 6.

The absorbent article preferably comprises from 40gm^{-2} to 90gm^{-2} , more preferably from 55gm^{-2} to 85gm^{-2} , most preferably from 60gm^{-2} to 65gm^{-2} of said zeolite.

Silica odour control agent

According to the present invention the odour control system comprises as an essential component silica. Silica i.e. silicon dioxide, SiO_2 exists in a variety of crystalline forms and amorphous modifications, and can be derived from both natural sources e.g. diatomaceous earth and synthetic sources, any of which are suitable for use herein. Silica molecular sieves do not fall within the definition of silica as used herein. In particular, silicas having a high surface area or in agglomerated form are preferred. Preferably the silica is in a highly purified form such that it contains at least 90%, preferably 95%, more preferably 99% silicon dioxide. Most preferably the silica is silica gel having a 100% silica content. Alternatively the silica may be provided from other sources such as metal silicates including sodium silicate.

Preferred silica include non crystalline silica (e.g. amorphous silica, appearing as white free flowing powder), having a particle size 4-12 microns, a pore volume 1-2 g/ml or a granular silica of aggregated particles (e.g. silica gel, having a maximum particle dimensions of 1.6 mm in diameter). More preferred is silica gel having a medium pore diameter of from 40 Å to 150 Å, preferably from 60 Å to 130 Å, most preferably from 90 Å to 110 Å, a surface area of from $100\text{m}^2/\text{g}$ to $800\text{m}^2/\text{g}$, preferably from $200\text{m}^2/\text{g}$ to $550\text{m}^2/\text{g}$, most preferably from $250\text{m}^2/\text{g}$ to $350\text{m}^2/\text{g}$ and an average particle size of 15 to 200 microns, preferably from 63 to 200 microns.

The absorbent article preferably comprises from 40gm^{-2} to 100gm^{-2} , more preferably from 60gm^{-2} to 90gm^{-2} , most preferably from 60gm^{-2} to 65gm^{-2} of silica based on 100% purity.

The ratio of absorbent gelling material to silica to zeolite is typically in the range of from 1:5:1 to 1:1:5, preferably from 1:3:1 to 1:1:3, most preferably from 1:1:1 to 1:1.5:1.5.

According to the present invention the weight of the odour control system which may be used in the absorbent article can be readily determined by the skilled person bearing in mind the absorbent article dimensions. For example, when utilised in a sanitary napkin or panty liner, the absorbent article may comprise from 0.5g to 5g, preferably from 1g to 3g, most preferably from 1.5g to 2.5g of said odour control system.

According to the present invention the odour control system may comprise additional optional components such as antimicrobial agents, perfuming ingredients, masking agents, activated carbon, and chelants, all of which are known to those skilled in the art.

The odour control system may be incorporated into the absorbent article by any of the methods disclosed in the art, for example it may be layered on the core of the absorbent article or mixed within the fibres of the absorbent core. The odour control system is preferably incorporated between two layers of cellulose tissue. Optionally, the system may be bonded between two cellulose tissue layers with, for example, a hot melt adhesive or any suitable bonding system.

More preferably the odour control system is incorporated in a layered structure in accordance with the disclosure of WO 94/01069 or Italian patent application number TO 93A 001028. TO 93A 001028 describes a layered structure substantially as described in WO 94/01069 with the exception that TO 93A 001028 comprises a much higher quantity of absorbent gelling material (AGM) in the intermediate layer which is between the fibrous layers (120gm^{-2}) that would be incorporated as an optional component in the present invention. The intermediate layer comprises, in particular, a polyethylene powder as thermoplastic material which is mixed with the premixed odour control system of the present invention. The mixture is then heated such that the polyethylene melts and glues the laminate layers and components together. The bridges which form the bond points between the fibrous layers involve particles of AGM

as well as particles of thermoplastic material. (The absorbent capacity of the AGM is unaffected by bonding.) The adhesive lines are preferably also placed on the edges of the laminate to ensure that the edges of the laminate stick and any loose odour control material does not fall out of the laminate.

Absorbent core

According to the present invention, the absorbent core can include the following components: (a) an optional primary fluid distribution layer preferably together with a secondary optional fluid distribution layer; (b) a fluid storage layer; (c) an optional fibrous ("dusting") layer underlying the storage layer; and (d) other optional components. According to the present invention the absorbent core may have any thickness depending on the end use envisioned.

a Primary/Secondary Fluid Distribution Layer

One optional component of the absorbent core according to the present invention is a primary fluid distribution layer and a secondary fluid distribution layer. The primary distribution layer typically underlies the topsheet and is in fluid communication therewith. The topsheet transfers the acquired fluid to this primary distribution layer for ultimate distribution to the storage layer. This transfer of fluid through the primary distribution layer occurs not only in the thickness, but also along the length and width directions of the absorbent product. The also optional but preferred secondary distribution layer typically underlies the primary distribution layer and is in fluid communication therewith. The purpose of this secondary distribution layer is to readily acquire fluid from the primary distribution layer and transfer it rapidly to the underlying storage layer. This helps the fluid capacity of the underlying storage layer to be fully utilised. The fluid distribution layers can be comprised of any material typical for such distribution layers. In particular fibrous layers maintain the capillaries between fibers even when wet are useful as distribution layers.

b Fluid Storage Layer

Positioned in fluid communication with, and typically underlying the primary or secondary distribution layers, is a fluid storage layer. The fluid storage layer can comprise any usual absorbent material or combinations thereof. It preferably comprises absorbent gelling materials in combination with suitable carriers.

Suitable carriers include materials which are conventionally utilised in absorbent structures such as natural, modified or synthetic fibers, particularly modified or non-modified cellulose fibers, in the form of fluff and/or tissues. Suitable carriers can be used together with the absorbent gelling material, however, they can also be used alone or in combinations. Most preferred are tissue or tissue laminates in the context of sanitary napkins and panty liners.

An embodiment of the absorbent structure made according to the present invention may comprise multiple layers comprises a double layer tissue laminate formed by folding the tissue onto itself. These layers can be joined to each other for example by adhesive or by mechanical interlocking or by hydrogen bridge bands. Absorbent gelling material or other optional material can be comprised between the layers.

Modified cellulose fibers such as the stiffened cellulose fibers can also be used. Synthetic fibers can also be used and include those made of cellulose acetate, polyvinyl fluoride, polyvinylidene chloride, acrylics (such as Orlon), polyvinyl acetate, non-soluble polyvinyl alcohol, polyethylene, polypropylene, polyamides (such as nylon), polyesters, bicomponent fibers, tricomponent fibers, mixtures thereof and the like. Preferably, the fiber surfaces are hydrophilic or are treated to be hydrophilic. The storage layer can also include filler materials, such as Perlite, diatomaceous earth, Vermiculite, etc., to improve liquid retention.

If the absorbent gelling material is dispersed non-homogeneously in a carrier, the storage layer can nevertheless be locally homogenous, i.e. have a distribution gradient in one or several directions within the dimensions of the storage layer. Non-homogeneous distribution can also refer to laminates of carriers enclosing absorbent gelling materials partially or fully.

c Optional Fibrous ("Dusting") Layer

An optional component for inclusion in the absorbent core according to the present invention is a fibrous layer adjacent to, and typically underlying the storage layer. This underlying fibrous layer is typically referred to as a "dusting" layer since it provides a substrate on which to deposit absorbent gelling material in the storage layer during manufacture of the absorbent core. Indeed, in those instances where the absorbent gelling material is in the form of macro structures such as fibers, sheets or strips, this fibrous "dusting" layer need not be included. However, this "dusting" layer provides some additional fluid-handling capabilities such as rapid wicking of fluid along the length of the pad.

d Other Optional Components of the absorbent structure

The absorbent core according to the present invention can include other optional components normally present in absorbent webs. For example, a reinforcing scrim can be positioned within the respective layers, or between the respective layers, of the absorbent core. Such reinforcing scrims should be of such configuration as to not form interfacial barriers to fluid transfer. Given the structural integrity that usually occurs as a result of thermal bonding, reinforcing scrims are usually not required for thermally bonded absorbent structures.

The topsheet

According to the present invention the absorbent article comprises as an essential component a topsheet. The topsheet may comprise a single layer or a multiplicity of layers. In a preferred embodiment the topsheet comprises a first layer which provides the user facing surface of the topsheet and a second layer between the first layer and the absorbent structure/core.

The topsheet as a whole and hence each layer individually needs to be compliant, soft feeling, and non-irritating to the wearer's skin. It also can have elastic characteristics allowing it to be stretched in one or two directions. According to the present invention the topsheet may be formed from any of the materials available for this purpose and known in the art, such as woven and non woven fabrics and films. In a preferred embodiment of the present invention at least one of the layers, preferably the upper layer, of the topsheet comprises a hydrophobic, liquid permeable apertured polymeric film. Preferably, the upper

layer is provided by a film material having apertures which are provided to facilitate liquid transport from the wearer facing surface towards the absorbent structure. If present the lower layer preferably comprises a non woven layer, an apertured formed film or an airlaid tissue.

Backsheet

According to the present invention the absorbent article comprises as an essential component a backsheet. The backsheet primarily prevents the extrudes absorbed and contained in the absorbent structure, from wetting articles that contact the absorbent product such as underpants, pants, pyjamas and undergarments. The backsheet is preferably impervious to liquids (e.g. menses and/or urine) and is preferably manufactured from a thin plastic film, although other flexible liquid impervious materials can also be used. As used herein, the term "flexible" refers to materials that are compliant and will readily conform to the general shape and contours of the human body. The backsheet also can have elastic characteristics allowing it to stretch in one or two directions.

The backsheet typically extends across the whole of the absorbent structure and can extend into and form part of or all of the preferred sideflaps, side wrapping elements or wings.

The backsheet can comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the backsheet is a polyethylene film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils).

Exemplary polyethylene films are manufactured by Clopay Corporation of Cincinnati, Ohio, under the designation P18-0401 and by Ethyl Corporation, Visqueen Division, of Terre Haute, Indiana, under the designation XP-39385. The backsheet is preferably embossed and/or matt finished to provide a more clothlike appearance. Further, the backsheet can permit vapours to escape from the absorbent structure, i. . be breathable, while still preventing extrudates from

passing through the backsheet. Also breathable backsheets comprising several layers, e.g. film plus non-woven structures, can be used.

Examples:

The sanitary napkins used in the following examples were Always (Always is a registered Trade Mark) as sold by the Procter & Gamble Company. Each napkin was opened by cutting the wrap around the perforated coverstock at its bottom face approximately along a longitudinal edge of the release paper which covers the external adhesive layer. The side of the absorbent fibrous core is then exposed by slightly shifting the water impermeable plastic bottom layer and subsequently, the fibrous core is split into two halves, each having approximately the same thickness, along a plane which is parallel to the plane of the napkin itself. The odour control system is homogeneously distributed between these two fibrous layers which are then joined together to reconstitute the absorbent core.

The water impermeable inner backsheet is then put back into its original position and the wrap around perforated coverstock is sealed along the cut by means of a e.g. a double sided adhesive tape.

Samples were produced using the method above, containing the odour control systems as described hereinbelow.

The zeolite (0.5g) used was zeolite A, Wessalith CS, available from Degussa AG. The silica (0.5g) used was Syloblanc 82 available from Grace GmbH or Silica FK 700, available from Degussa. The AGM (0.7g) used was XZ 9589001, available from Dow Chemicals.

WHAT IS CLAIMED IS:

1. An absorbent article comprising a liquid pervious topsheet, a backsheet and an absorbent core intermediate said backsheet and said topsheet, characterised in that said absorbent article napkin comprises an odour control system comprising the combination of zeolite, silica and absorbent gelling material.
2. An absorbent article according to claims 1, wherein said zeolite has a ratio of SiO_2 to AlO_2 of at least 1.
3. An absorbent article according to claim 2, wherein said zeolite has ratio of SiO_2 to AlO_2 of from 1 to 500.
4. An absorbent article according to any one of the preceding claims, wherein said zeolite is selected from zeolite A, zeolite X, zeolite Y, zeolite DAY, zeolite ZSM-5 and mixtures thereof.
5. An absorbent article according to any one of the previous claims, wherein said zeolite is zeolite A and zeolite Y and mixtures thereof.
6. An absorbent article according to any one of the preceding claims, wherein the ratio by weight of said absorbent gelling material to silica to zeolite is from 1:5:1 to 1:1:5.
7. An absorbent article according to any one of the preceding claims, wherein said absorbent article comprises from 0.5g to 5g of said odour control system.
8. An absorbent article according to any one of the preceding claims, wherein said article comprises from 40gm^{-2} to 90gm^{-2} zeolite.
9. An absorbent article according to any one of the preceding claims, wherein said article comprises from 40gm^{-2} to 100gm^{-2} silica.

10. An absorbent article according to any one of the preceding claims, wherein said article comprises from 20gm^{-2} to 150gm^{-2} absorbent gelling material.
11. An absorbent article according to any one of the preceding claims, wherein said absorbent article is a sanitary napkin or a panty liner.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/08972

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A61F 13/15

US CL : 604/359

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/359-364, 368

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,407,442 A (KARAPASHA) 18 April 1995, col. 4, lines 22-39; col. 6, lines 54-62; col. 9 line 65 to col. 10 line 43; and col. 11, lines 5-22.	1-4

☐

Further documents are listed in the continuation of Box C.

☐

See patent family annex.

* Special categories of cited documents:	* T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* A document defining the general state of the art which is not considered to be of particular relevance	* X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
* E earlier document published on or after the international filing date	* Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
* L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	* & document member of the same patent family
* O document referring to an oral disclosure, use, exhibition or other means	
* P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

21 JULY 1997

Date of mailing of the international search report

19 AUG 1997

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Authorized officer

ROBERT A. CLARKE

Stacia Jimcik
for

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/08972

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 5-9
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.